X

NOTE

ON AN

INSPECTION OF THE FORESTS

IN

ASSAM

DURING JANUARY TO APRIL 1889.

BY

B. RIBBENTROP,

INSPECTOR-GENERAL OF FORESTS TO THE GOVERNMENT OF INDIA.

SIMLA:
PRINTED BY THE SUPERINTENDENT, GOVERNMENT CENTRAL PRESS.

1889.

634.9
R483 AS

SIMLA:
PRINTED BY THE SUPERINTENDENT, GOVERNMENT CENTRAL PRESS.
1889.

3862

TABLE OF CONTENTS.

	PAGE.
Introduction	1
General	*ib.*
Classification of Forests	*ib.*
Geographical Distribution of the different classes of Forests	*ib.*
Forest Administration in reference to the different classes of Forests ...	4
Savannah Forests	*ib.*
Sâl Forests	*ib.*
Extent of the Government Sâl tracts	*ib*
Reservation of Sâl Forests, present and proposed ..	5
Fire-protection of Sâl Forests	7
Present Exploitation and future systematic Management of Sâl Forests	8
Sissu and Acacia-Catechu Forests	12
Mixed Deciduous Forests	*ib.*
Teak Plantations in Mixed Deciduous Forests	13
Evergreen Forests	14
Value of Evergreen Forests	*ib.*
Reservation of Evergreen Forests	15
Working of, and Working-Plans for, Evergreen Forests... ...	16
Caoutchouc Mahals	17
Ficus-Elastica Plantations	18
Bamboo Forests and Cane-brakes	19
Pine Forests	*ib.*
Miscellaneous	20
Forest Law	*ib.*
Concessions	*ib.*
Working-Plans for Assam	21
Establishments	*ib.*
Summary	22

APPENDICES

A.—Areas of Demarcated State Forests in Assam	24
B.—List of Trees in the Garo Hills Division, Assam	*ib.*

INTRODUCTION.

In 1879 Mr. (now Sir Dietrich) Brandis, the then Inspector General of Forests, visited the Assam Valley and wrote his exhaustive and remarkable volume of "Suggestions regarding Forest Administration in Assam." Ten years later, on the 4th January 1889, I entered the Province, following the footsteps of my predecessor, near Haldibari on the Sankos river.

2. It was necessary, in order to enable me to gauge the effects of the Forest policy introduced in 1879, that I should gain a personal knowledge of the conditions of the whole country in respect to Forest Administration, and it was for this reason that a somewhat extended tour was contemplated during Mr. Gustav Mann's incumbency of the Conservatorship, which is drawing towards its close. Mr. Mann has been in charge of the Forest affairs of Assam ever since 1868, and his knowledge of the physical and economical conditions of the country is unrivalled.

I met Mr. Mann at the Haldibari ferry, and, in company with him and the respective District Forest Officers, I visited the most important forest areas in the Assam Valley, from the sâl forests in the Goalpara Duars in the west of the Province to the evergreen forests in the Lakhimpur District. I crossed the Sankos river on the 4th January, and reached Shillong on the 22nd March.

GENERAL.

CLASSIFICATION OF FORESTS.

3. The constitution and distribution of the various classes of forests are not subject to rapid changes, and the volume of Suggestions published in 1879 contains in Chapter I a description so exhaustive and so accurate that almost nothing remains to be added. This volume must, in this and in many other respects, remain for years to come the handbook of Forest Administration in Assam.

4. The character of the forests varies with the distribution of the rainfall, the formation and elevation of the country, and the conditions of the sub-soil. It is also to a considerable extent influenced by the density of the population, and even more so by their mode of agriculture, and it is this latter fact which I intend to point out more particularly in the following paragraphs.

In the few remarks I intend making in regard to the character and distribution of the forests, I retain the classification adopted by Sir Dietrich Brandis, which is as follows:—

(*a*) Savannahs.
(*b*) Sâl forests.
(*c*) Sissu and Khair forests.
(*d*) Mixed deciduous forests.
(*e*) Evergreen forests.
(*f*) Bamboo forests.
(*g*) Cane-brakes.

To these I add (*h*) Pine forests.

GEOGRAPHICAL DISTRIBUTION OF THE DIFFERENT CLASSES OF FORESTS.

4. The *Grass savannahs* are either the consequence of frequent and somewhat protracted inundations, or are caused by annual conflagrations, which have destroyed the original forest growth, and allow nothing but grass to come up.

The former class of savannahs—those caused by inundations—we find only on the churs of the Brahmaputra and in the close vicinity of its main tributaries. They occupy very extensive areas, generally unfit for the production of forest, and mostly also unsuitable for permanent cultivation. Some of the low-lying lands in the east of the Province are, where the soil has great water-retaining power, clothed with an evergreen swamp forest.

The savannahs which owe their origin to fire occupy a large extent of country in the plains, mostly in the Goalpara, Kamrup, Nowgong, and Darrang Districts. They include extensive localities of rich culturable land, and, on the higher-lying ground, lands of a considerable aggregate area, which would be of greater value if covered with Sâl forests.

These savannahs are the grazing grounds of the Province, but the area is out of all proportion to the small number of cattle kept.

5. The savannahs or open grass-lands in the hills are also very extensive, especially in the mountain range south of the Brahmaputra. In fact, the whole of the uppermost slopes of these hills, beyond a narrow belt of forest and nearly the whole of the plateaux, are forestless. These hill savannahs have without doubt been caused by centuries of shifting cultivation and continuous firing.

The soil throughout this range is a naturally rich loam with great latent power of production, and only waits for a rational system of husbandry to yield large returns in spite of the impoverished state of its surface.

The highly flourishing garden cultivation in the vicinity of hamlets and villages points to this. Such intensive cultivation, however, is very limited, and, though the nature of the whole country has altered and deteriorated, the present general system of agriculture is still of the undeveloped and shifting character which originally led to the destruction of the forests and of the productive power of the soil.

In the higher ranges of the Khasia Hills, the people can in some places return to the same areas not oftener than three times during a century. This, however, is exceptional; but the average length of rotation is upwards of 10 years for grain crops. The development of this tract of country, without an entire change of its agricultural system, is consequently impossible.

6. The *Sâl forests* are found in areas where the annual rainfall is below 80 inches, or where, when it exceeds this amount, the surface or sub-soil drainage is exceptionally good. It is more than probable that the heavier rainfall and the more sluggish drainage in Upper Assam fix the eastern limit of the tree and prevent its spreading into this part of the Province.

The Sâl forests within Assam thus occupy a belt below the Himalayas, where the local rainfall and the water rushing off the hill-slopes disappear in the boulder-beds underlying the surface-soil. The Sâl tree next favours the stretches of high-lying ground which shoot out from this waterless region, and which are intersected by the numerous streamlets that here reappear on the surface. In these localities, further removed from the hills, the rainfall is naturally somewhat less and the drainage perfect. The banks of the rivers and the low-lying ground between the ridges are occupied by an inferior forest of a more or less evergreen character. The eastern limit of Sâl forests on the north of the Brahmaputra is conterminous with the boundary of the Goalpara District. The abrupt termination of Sâl is, however, greatly due to the poor, sandy, and gravelly character of the soil in the greater part of the country in the north of the Kamrup District, for a few clumps of fine trees are found in particularly favourable situations as far east as the Borelli river in the Tezpur District.

To the south of the Brahmaputra, the Sâl forests occupy the lower slopes of the Garo Hills, the lower northern slopes of the Khasia and Jaintia Hills, and the spurs and high-lying grounds jutting out from these and the north-western face of the Mikir Hills. Sâl forests also occupy the outlying hills which are connected with the main ranges, both to the north and south of the Brahmaputra, in the Goalpara and Kamrup Districts.

7. The compact Sâl forests on the waterless tracts and high-lying grounds between the reappearing streamlets and rivers have, owing to the unsuitableness of the ground for cultivation, escaped to a great extent the axe of the *jhúm* cutter; but the annual fires spreading from the natural savannahs have gradually encroached on them, and grass-lands now occupy large areas of former Sâl tracts.

The Sâl forests in the hills have everywhere suffered by the shifting cultivation, and whole hillsides in the most favourable situations have been transformed into Bamboo forests, with solitary Sâl trees here and there, indicating the former character of the forests. The Sâl forests in the plains are more or less pure, whereas those situated in the hills are mixed. This may, however, to a great extent be due to *jhúming*, for we find areas which have escaped this destructive method of cultivation clad with magnificent forests of pure Sâl. Some compartments in the Dambu Forest are a good example of this.

8. The area occupied in Assam by *Sissu and Khair forests* comprises only the stretches below the waterless Sâl region, where the soil is too sandy and gravelly for the growth of Sâl. This forest is best developed on the banks of the Manás and Sankos rivers, but also occurs in isolated stretches throughout the greater part of the Kamrup District and in Darrang, shading into a mixed deciduous forest towards the slopes of the Himalayas. Continuous firing transforms this class of forest into savannahs.

9. The *Mixed Deciduous forest* is found all over the Province as an outer fringe of the evergreen forests, and on the drier ridges is intermixed with forests of an evergreen character. There is no distinct boundary between the forests of these two classes. *Jhúming* and constant firing have transformed the deciduous forest into either inferior Bamboo forests or savannahs, according to their situation. These hill savannahs were once no doubt occupied to a great extent by forests of a deciduous character, though they have also encroached on evergreen forests on the one side and Pine forests on the other.

10. The *Evergreen forests* are found both in the plains and in the lower hills adjoining the latter, where the rainfall is upwards of 80 inches, and where the subsoil permits of the retention of the water near the surface. The whole of Upper Assam, excepting some savannah lands and Bamboo forests, may be said to be covered with evergreen forests wherever no clearings have been made for cultivation; and a belt of forest of this character, of varying breadth and extending into the side valleys, skirts the Himalayas, as well as the northern face of the southern hill range.

The evergreen forests exhibit a great variety of character, not only towards their outer edges, where they shade into deciduous forests, but also according to their situation, whether in the west and east of the valley, and their elevation. Certain trees are found constant in all evergreen forests, but the intermixture of Nahor (*Mesua ferrea*), for instance, gives quite a distinct character to the forests in the upper valley, where other forests situated on undulating ground are marked by a large admixture of *Dipterocarpus turbinatus* and *Shorea assamica*.

11. A large amount of shifting cultivation takes place within these evergreen forests; but fires do not spread beyond the limits of the areas on which the forest has been cut down and dried; and as soon as the *jhúms* are abandoned, the forest growth rapidly regains possession of the ground. It is only where the *jhúming* population is dense that the character of the forest is permanently injured.

Where the forest is only semi-evergreen, continuous firing will, however, transform it into a savannah, or will at least prevent the original forest from taking possession of ground which has been deserted after having been under permanent cultivation. The savannahs of the Jamuna and Kopili valleys, in the Nowgong District, owe most probably their existence to the above-mentioned circumstances.

12. There are unmistakeable indications that the easternmost plains of the Brahmaputra Valley, which are now clothed with dense evergreen forests, were

within a recent period under permanent cultivation; and that the valley of the Dhansiri river was once the centre of the Cachari kingdom is testified by the ruins of Dimapur. At present this old city lies in the midst of unpenetrable jungle and cane-brakes, with forest trees growing in its markets and roots rending its old fortifications and castles; while the whole country round about is at rest, gathering wealth of reproductive power, till it will some day be awakened by the progress of civilization.

13. Sir Dietrich Brandis notices the *Soom* forests of Upper Assam as a remarkable sub-division of the class of evergreen forest. They are almost invariably in compact and more or less isolated blocks, and I am convinced that Mr. Mann is correct in ascribing their origin to the plots which were planted round the formerly existing villages, and which have grown and spread whilst the rest of the deserted country was being overrun by spontaneous forest growth.

14. The *Bamboo forests* of Assam are either the consequence of shifting cultivation or of artificial origin. In the former case, they vary in character in accordance with the forest which originally occupied the ground, or primarily in accordance with the distribution of rainfall and the water-retaining power of the soil. Thus, in the Garo Hills and where the forest has not been of an entirely evergreen character, the *terai* Bamboo (*Melocanna bambusæoides*) overruns the old *jhúms*, whereas in the purely evergreen forest areas the *kakoa* Bamboo (*Dendrocalamus Hamiltonii*) takes the place of the original forest, or forms at least the chief undergrowth.

15. *Cane-brakes* occupy in Assam more or less all low and swampy places in evergreen forests.

16. The *Pine forests* (*Pinus Khasya*) are found in the Khasia Hills above an elevation of 2,500 feet Where these forests have been destroyed by *jhúming* and fire, hill savannahs are the result.

17 In order to justify such expansion or contraction of the Forest policy of 1879 as I think advisable and contemplate proposing, I have attempted in the foregoing paragraphs to show the manner in which and the extent to which shifting cultivation and indiscriminate firing influence the character and distribution of the different classes of forests.

FOREST ADMINISTRATION IN REFERENCE TO THE DIFFERENT CLASSES OF FORESTS.

SAVANNAH FORESTS.

18. These are of interest to the Forest Administration only in so far as they occupy land suitable to bear forests, and in such cases I have treated of them under the class of forests the place of which they occupy.

SAL FORESTS.

EXTENT OF THE GOVERNMENT SÂL TRACTS.

19. These forests form the most important forest resources of the country. They supply timber for the Bengal market and yield a handsome revenue to the Province, while they rarely occupy land fit for permanent cultivation. Owing to the Permanent Settlement, some 500 square miles of the most valuable and most favourably situated Sâl areas in the plains of the Goalpara District have for ever been alienated, and are now the property of zamindars. These private forests have all been more or less ruined, but with fire-protection and rest they will in a very short time regain their lost productive power, and will again become a magnificent forest property. The lower slopes of the western and north-western face of the Garo Hills, the natural home of the Sâl tree, are also the property of the Goalpara zamindars. This area is bounded by

straight lines arbitrarily drawn across the map, indicating a boundary which in practice can never have existed on the ground. The property, known as the A and B Mahals, has been alienated, but it is managed on behalf of the proprietors by Government, which on account of such management takes a certain share of the revenue. Government cannot, however, enforce the reservation of any forests within these mahals, as it is not a part-proprietor, but merely a managing agent. The same fact holds good in regard to the Khasia Hills, which are partly independent territory.

20. I have already pointed out in previous paragraphs that the extent of the Sâl-producing tracts has been seriously curtailed by savannah fires in the plains and by jhúming, and the consequent firing, in the hilly portion of Lower Assam. It has sometimes been asserted that the Sâl forests in the Duars were stationary, and even extended in spite of the savannah fires. This, however, is not so. An encroaching forest throws out arms like an octopus, taking steady possession of the most favourable ground, and the boundary thus becomes serrated; whereas a forest contracting before the constant influence of either fire or inundation has an abrupt outer edge, and is surrounded by unconnected outlying patches, the remnants of the original forest still keeping possession of the most favourable ground. In this latter condition we find the unprotected Sâl forests in the plains of Lower Assam; in the former, the fire-protected areas.

RESERVATION OF SÂL FORESTS, PRESENT AND PROPOSED.

21. The greater portion of the Sâl-producing tracts in the waterless region and the high stretches of ground in the western portion of the valley has, in so far as they are Government property, been reserved during the last fifteen years. These Reserves contained and still contain a considerable proportion of savannah lands, which, however, under the influence of fire-protection, are rapidly reclothing themselves with Sâl forest. The process of natural re afforestation is much more uniform and rapid than was originally expected and more complete, and for this reason I now recommend that all outlying patches of Sâl forest in tracts of the above description, with extensive areas of savannah land suitable for the growth of Sâl trees around them, be added to the existing Reserves. The aggregate area of the Reserves proposed will probably not be very extensive; but such patches exist in the Goalpara District to the south and east of the present main block of Sâl Reserves, and in the south-west corner of the Kamrup District. Reserves thus formed need only be fire-protected in order to be reconverted into valuable Sâl forests. The proportion of Sâl trees in these areas is, of course, much smaller than in the Reserves originally selected, and the process of conversion will naturally be much more protracted than that of the savannahs in close vicinity to or interspersing the more compact Sâl forests. But we can afford to wait; fire-protection is not very expensive in the plains of Lower Assam; its success has been almost rendered a certainty, and the value of the land under the present conditions is almost *nil*. The area of the savannahs, exclusive of the tracts I propose for reservation, is so vast, and the number of cattle which make use of them is so small in proportion, that the withdrawal of an additional 100 square miles for Forest purposes will not be felt or even noticed.

22. In the hilly portion of Sâl-producing tracts the reservation has been much more restricted than in the plains. It may be that this was done for political reasons, or because the condition of the country was less known. Whatever the cause may have been, only the most valuable Sâl forests—those which had either escaped being destroyed by shifting cultivation or which had recovered that treatment—were, in accordance with the Forest policy of 1879, reserved. A glance at the map will show that the areas which were reserved on these principles form but a small proportion of the lower hills. The rest of the area has been subject to occasional *jhúming* at some time or other, though less so of late years, as the *kala-asar*, a deadly local disease, has destroyed a large portion of the population.

The fire-protection of some of these hill forests has, however, proved that but little else is required to ensure a re-afforestation of the destroyed Sâl

forest; and fortunately we find all along the northern slopes of the Lower Assam hills large tracts where a sufficient number of parent trees, or at least trees which would soon grow into seed-bearers under the influence of fire-protection, still exist. The question is whether, under such circumstances, it is justifiable to allow *jhúming* to be rampant throughout the length and breadth of this country. I think not, and believe that, without interfering with the material well-being of the people even in their present mode of life, it is possible to restrict this destructive form of cultivation to defined areas by the same means which have in this respect been adopted in Burma.

23. I would thus propose that extensive Reserves should be made on the northern drainage area of the Garo Hills, where the land is at the disposal of Government; also at the foot of the Khasi and Jaintia Hills, and on the north-west slopes of the Mikir Hills; and that, within these Reserves, compact areas be demarcated for the exercise of shifting cultivation, sufficient ground of a suitable kind for a liberal rotation being awarded for each family. I am convinced that, after allowing for all requirements on a most liberal scale, a large surplus will be available for *bonâ fide* Forest purposes. The areas demarcated for *jhúming* should form part of the Reserves for the following reasons:—

(*a*) It will prevent the encroachment of new settlers, and thereby render an increase of the *jhúming* population by influx from without impossible.

(*b*) It will prohibit for ever the destruction of forests by traders in unreserved forest-produce—a thing not likely to happen at present, but which must be foreseen.

(*c*) It will enable us to cancel, within the areas, the rules with regard to reserved trees.

(*d*) It will facilitate the control of forest fires and the general management of the Reserves.

The rights which I propose should be conceded to the right-holders within these areas are as follows:—

(*a*) To cut *jhúms* within the portion assigned to them inside the limits of the Reserve.

(*b*) To burn such *jhúms*, provided they take the necessary precautions against fire spreading in the forest from these or neighbouring *jhúms*.

(*c*) To provide themselves within their limits with any forest-produce.

The Government will, of course, fire-protect all Reserves *en bloc*, including demarcated *jhúm* areas, thereby rendering such areas of much greater value to the right-holders.

24. The area of Sâl forest and Sâl-producing land at present included in the existing Reserves is estimated to be as follows:—

District.	Area, in square miles.		
	Sâl forest.	Savannah or Bamboo on Sâl producing ground.	Total Area.
Goalpara	350	50	400
Garo Hills	80	53	133
Kamrup	120	8	128
Nowgong	50	61	111
Total ...	600	172	*772

N.B—*Of these, some 350 square miles lie in the hills.

FIRE-PROTECTION OF SÂL FORESTS.

25. The history of fire-protection dates from 1873-74, but the success which attended the first efforts was very varying and very limited. It took some years before the work was properly understood, and it is only since 1884-85 that the results have been entirely satisfactory.

Considerable areas have, however, continuously escaped fire since 1875-76, and at present some 270 square miles of the Sâl forests are under permanent protection, as follows :—

121	square miles	in the	Goalpara	District.	
98	"	"	"	Kamrup	"
34	"	"	"	Nowgong	"
10	"	"	"	Garo Hills	"
7	"	"	"	Darrang	"
TOTAL ... 270	square miles.				

26. The effect of fire-protection in the sub-montane Sâl forests of Assam is marvellous. Wherever there is a sufficiency of light overhead, the young growth springs up as close as it can grow within the existing forest; small open spaces, but lately covered with high grass, have been transformed into young Sâl thickets, and even the larger savannahs included within the ring of fire-protection disappear rapidly under the advancing young growth of Sâl. In close vicinity to the parent forest, as well as round solitary seed-bearers, dense masses of young seedlings battle shoulder to shoulder with the high grass, and further away from the seed bearers we see the heads of single saplings appearing here and there above the savannah.

It is difficult to predict how long it will take till the larger savannahs are entirely filled up, as the process must naturally become slower the further away from the seed-bearers it takes place; and if the areas are very extensive, it may even be retarded until some of the present young growth bears seed—an occurrence which will take place some 20 years hence. I should say, and the local Officers agree with me, that during the last 10 years the savannahs within the fire-protected area have contracted by 50 per cent.; and so much is certain that no forest could have behaved more gratefully under the protection afforded. These results, which in 1879 it was not anticipated would be anything like so favourable, make it an imperative duty to protect every acre of the sub-montane Sâl forest; and the necessary money and establishment must be found. It will probably not amount to more than Rs. 5,000 per annum.

27. The first attempt at fire-protection in the hill Sâl forests also dates from 1873-74. The results, though not so rapid, universal, and unqualified as in the submontane Sâl forests, are nevertheless all that can be desired.

Where forest already exists on the ground, the young growth springs up within the first few years of fire-protection; newly *jhûmed* areas soon show a crop of seedlings, and it is only within Bamboo jungle that the density of the cover overhead seems for the time to restrict the coming up of the young forest. But even in forests of this class we find scattered seedlings, and we may hope to re-establish a complete forest growth by means of protection only. There may be exceptional areas which will resist, too long for our purposes, the efforts of the forest to re-establish itself, and it may become advisable in such cases to assist nature by arboricultural operations of the cheapest kind.

28. I would recommend that the system of arbori-taungya cultivation, which is immensely successful in Burma, be introduced and tried in some of the fire-protected areas which are clad with a forest of Bamboos too dense to allow of

natural reproduction. The main features of this system of arboriculture are that shifting cultivation is permitted on selected areas within a fire-traced block; that fire is strictly confined to the area to be cultivated; and that seedlings of the species it is desired to reproduce are planted, together with the first crop, in lines 6 feet apart and at a distance of 6 feet within the lines; or, as the case may be, seed may be sown at stake in equidistant patches of 6 feet, or on slightly raised continuous ridges 6 feet apart. The cultivators are paid at the rate of Re. 1 for every hundred plants, or every hundred successful patches of seedlings, or every 725 running feet of successful ridge cultivation. Experience has shown that plantings or sowings at a greater distance than 6 feet do not produce a crop sufficiently dense and powerful to struggle successfully with the growth of weeds and Bamboos which springs up on a deserted *jhúm*.

When the people once take to this practice, they soon find out that, though the result wished for by the Forest Administration is cheaply attained, their labour has been well paid for. They would, under any circumstances, cut their *jhúms* somewhere in the vicinity, and, by a few days' additional work, they can gain as much as Rs. 10 per acre, or Rs. 40 to Rs. 50 per family.

29. Fire-protection in the hill Sâl forests is being rendered unnecessarily difficult and costly by the scattered and isolated position of the Reserves, and by the utterly impractical boundaries which have, in many instances, been arbitrarily fixed by the Forest Settlement without the slightest reference to the features of the country.

The extension of forest reservation and the conservation of large compact blocks, including the areas set apart for shifting cultivation which I have proposed in previous paragraphs, will facilitate fire-protection, and reduce the cost per square mile; and larger areas will derive the benefit from the same amount of money and labour spent on the protection of the present scattered areas. The results attending successful fire-protection are, however, sufficiently valuable to render it advisable and necessary that, even whilst existing circumstances are allowed to last, it should be extended to every square mile of hill Sâl forest at present reserved.

The outlay in this respect will not probably be so easily recouped as in the sub-montane Sâl forests; but in cases of this description it is necessary to look beyond the present, and the additional expenditure required will, moreover, hardly amount to more than Rs. 4,000 or Rs. 5,000 per annum.

PRESENT EXPLOITATION AND FUTURE SYSTEMATIC MANAGEMENT OF SÂL FORESTS.

30. The local demand on the Sâl forests is very limited, and, apart from the requirements of the Public Works Department, is not likely to expand much, as the private Sâl forests are in this respect much more favourably situated, and can, however mismanaged, yield the material required by the inhabitants of the country, who require only timber of small dimensions.

The treeless plains of Lower Bengal constitute, however, an ample market for the Sâl timber grown in the Government forests of Western Assam; and it is for this reason that we must put our house in order and arrange for the largest possible permanent outturn at the lowest possible cost.

Under the present system of working, there is no security that either of these objects is effected, for the officers of the Forest Department, though they can under the existing system of management veto the removal of any particular tree, have far too little voice in the selection, from a Forester's point of view, of the trees felled; and the number annually extracted is as yet regulated by the demand only.

31. The intending purchaser pays a deposit for a certain number of trees. He then proceeds to the forest and himself selects the trees he wishes to fell; these, if no sylvicultural reasons exist against their removal, are marked by the officer in charge of the Range. The contractor then fells and logs the selected trees, whereupon the logs are measured, marked, and registered by the Forest Department. The contractor next removes them to the sâl depôt, and here the Bengali trader takes them over. The contractor pays the balance of royalty due before they are removed.

The royalty per Sâl tree is Rs. 10, independently of its contents or its distance from the export line, or any other reasons which it might be thought would influence its value.

32. As far as I can ascertain from the records, some 26,000 trees were thus extracted from 1874-75 to 1887-88 from the forests in the Goalpara District.

The valuation surveys of 1873-74 and 1874-75 gave the following results:—

From the Chirang Forest, west of the Saumukha river, 36 square miles:—

Girth.				Trees.
Under 1½′	...	...	...	533,323
1½′ to 3′	..	...	...	384,289
3′ to 4½′	...	...	...	98,690
4½′ to 6′	...	...	...	18,490
Above 6′	...	...	...	1,112
		TOTAL	...	1,035,904, or 45 trees per acre.

For the Sidli Forest, 36 square miles:—

Girth.				Trees
Under 1½′	...	...	...	982,471
1½′ to 3′	...	...	...	376,083
3′ to 4½′	...	...	...	49,608
4½′ to 6′	...	...	...	5,820
Above 6′	...	...	...	...
		TOTAL	...	1,413,982, or 61 trees per acre.

Roughly applying the valuation surveys of 1873-74 and 1874-75 of the Chirang and Sidli Forests to the whole area estimated to be under Sâl, it is evident that some 26,000 first-class trees were available in 1874-75; so that up to 1887-88 nothing beyond the accumulated stock of first-class trees was extracted.

Estimating on the same basis and in the same rough and ready manner, we find that the stock of trees between 3 to 4½ feet in girth on this area amounted in 1874-75 to 250,000, and, granted that only 50 per cent. would reach a girth of upwards of 4½ feet, 125,000 would reach maturity in 1901, or in 28 years—a period which will doubtless be considerably curtailed by the beneficial influence of fire-protection. On former occasions 28 years had been accepted as the time required in these localities for a Sâl tree 3 feet in girth to attain a girth of 4½ feet.

If we are so far correct, it may safely be assumed that the Goalpara Forests now contain 60,000 trees above 4½ feet girth; that another 60,000 will grow to that size during the next half of the period considered necessary for the growth of 2nd-class trees into those of the 1st class; and that the possible yield of the forests for this period (ending in 1891-92) is not less than 120,000 trees, or upwards of 8,000 trees per annum.

33. The above rough estimate is based, however, on several uncertain factors, chief amongst which is the want of a definite knowledge of the extent of the area actually under Sâl; and as the demand and consequent outturn in 1888-89 reached the limits of the possible yield shown in the above rough forecast, it seems imperative that no time should be lost in introducing a more systematic method of working, and that a more reliable forecast should be framed.

34. There can be no difference of opinion, I think, that the basis of the future working of these forests must be that of area pure and simple; for I need hardly point out that, considering the impossibility of gauging the potential capability of a forest constantly changing under the influence of

fire-protection, the most elaborate calculations and schemes would have in reality no greater claim to accuracy than my sketch-estimate in the foregoing paragraphs, and would require an area-check, even if based on a complete enumeration of the growing stock, an operation involving a very large outlay. Under the circumstances, it will be preferable, and in my opinion essential, that the sub-montane Sâl-producing forest tracts should be accurately surveyed with special reference to the character and composition of the forest.

For the purpose of such survey, the different classes of forest in the area in question should, as soon as possible, be separated. It will be necessary to show apart Sâl forests, areas suitable for Sâl, unproductive savananahs, and belts of evergreen and mixed forests in which Sâl is not represented.

The Sâl-producing tracts should be divided into—

(*a*) pure Sâl;

(*b*) Sâl in mixed forests;

(*c*) savannahs suitable for the growth of Sâl.

The first two classes should be sub-divided into two or three (I would certainly not have more) sub-classes in reference to their quality; and under savannahs it should be shown to what extent reproduction has already progressed. This separation of the different classes of forests in the Goalpara plains is the most urgent work before the Assam Working-Plans Officer; and linear valuation surveys of trees of the first class may hereafter be used in order to estimate the outturn of the next few years.

35. The maps of the Sidli, Bengtol, Bhumeswar, Panbari, and Guma Reserves have been constructed on the basis of the 1-inch Revenue Survey, and it is probable that they are sufficient for all practical purposes. They should be tested in order to ascertain this. Under any circumstances, new surveys will have to be made of the Chirang, Sankos, Bhur, Ripu, Jengasi, and Atiabari Reserves, estimated to contain some 388 square miles.

In my opinion, this work is of such urgency that the Government of India should be asked to make a party of the Imperial Forest Survey Branch available for it during the next open season. There will be no difficulty in arranging the constitution of such a party, as the surveyors employed in completing the surveys of the leased forests in Tehri-Garhwal in the North-Western Provinces and those engaged in the Naini Tal Division will by that time have finished their present work. It would be of great assistance if the services of a local Forest Officer trained in surveying, of which there are several in Assam, could also be rendered available for the survey work.

36. The detailed survey completed, the compilation of simple and feasible working-plans for the Sâl forests in the plains of the Goalpara District does not seem to me to present much difficulty.

The former valuation surveys of the Sidli and Chirang Forests show a very large number of third-class trees below 3 feet girth; and, in my opinion, we need not hesitate to extract the whole of the trees which will grow to upwards of 4½ feet girth within the first period. After the lapse of this period it may be predicted with great certainty that, provided fire-protection is extended to the whole area and successfully continued, the outturn will be at least double.

37. The introduction of systematic management with regard to the Sâl forests on the slopes of the Garo, Jaintia, Khasia, and Mikir Hills is second only in importance to the above scheme; but progress in this direction cannot be general until the policy of further reservation has been decided upon.

38. It has already been stated that the Government Sâl forests in Lower Assam must for years to come be exploited for one market, which draws its supplies by one main line of export, the Brahmaputra; that the forests in question form large compact areas, and that they are included in vast forest tracts more or less uninhabited; so that labour has, under any circumstances,

to be brought from without. The character of the forests is, moreover, such that they require very little constant attention beyond fire-protection. In these circumstances, it seems a matter of no particular importance that each forest and even each working-circle should yield a constant annual outturn of timber, so long as the permanency and constancy of the general supply is secured.

Every working-plan for forests of this description should therefore, in my opinion, form part of one general scheme for the exploitation of the Sâl forests of Lower Assam; and the continuity of supply from a single forest should be of quite secondary consideration.

39. The improvement of the *growing stock* in regard to quantity is amply secured by protection only; but improvement as regards *quality* of the *already existing stock* may frequently require special measures. This fact must not be lost sight of, and must form, when circumstances require it, one of the leading features of the working-plans, in which improvement cuttings should be prescribed, even though these operations may yield no present revenue. I have written these remarks with special reference to some forests I traversed on my road from the Kulsi plantation to Gauhati, which, in consequence of bad usage, are full of malformed timber; but the same remarks are no doubt applicable to many other localities in the Sâl forests in Assam.

40. In framing working-plans for the systematic working of the Sâl forests in Lower Assam, it will, in my opinion, be advisable to consider the improvement of the present manner of exploitation with a view to obtaining the largest possible net profit from the timber extracted.

It is scarcely conceivable that this end can be gained by charging a fixed royalty per tree independently of its cubic contents and position. Apart from the fact that this manner of exploitation renders a methodical working of the forests extremely difficult, if not impossible, it is clearly opposed to a concentration of the work, and does not consequently admit of the cost of export being cheapened by means of roads and tramways, and other measures undertaken with a view to reducing the amount of manual labour. At present the work (I except the Dambu Forest) is almost entirely done by men. Extraction of Sâl timber has become quite a distinct occupation, especially in the Goalpara District, and is carried on on socialistic principles. The capitalist of the undertaking is called the *duffadar*; he selects the trees to be felled, pays the royalty, all floating and minor expenses, and the cost of sacrifices considered necessary in order to propitiate the jungle spirits; he makes also advances to the labourers and feeds them while at work, and it is he who sells the timber. When the sale has been effected, half of the gross proceeds go to the duffadar; the other half is divided amongst the labourers, who then repay the duffadar the advances made by him, as well as the cost of their feed and keep.

41. The trees are almost invariably cut up into short logs of 7 feet length, called *dhums*, partly because timber of this length is most in demand for boat building and partly because logs of greater length would be less manageable, for they are rolled to the water's edge by men lying on their backs and pushing them with their feet.

Considering the high cost of manual labour in Assam, the fact that logs have often to be rolled for miles, and that the formation of the ground almost invariably admits of the easy construction of roads, it becomes evident that the cost of transport forms by far too large an item in the cost of timber sold on the Brahmaputra.

42. It should, therefore, be the aim of the Forest Department to introduce a system of working similar to that by which Teak timber is extracted in the Pegu Circle in Burma. There the Forest Department marks the trees for exploitation, and a contractor removes the timber on account of Government, being remunerated by certain payments per ton for delivery at the sale depôt; the remuneration varying with the size and class of the timber, the distance of land and water transport, and other circumstances. The contractors are given advances in the shape of elephants, the price of which is deducted as timber is delivered.

43. It is not to be expected that the Assam duffadars will at once take to this manner of working, and it will, in the first instance, be necessary that Government should prove to them that it is more profitable than the present method. Under these circumstances, I have no hesitation in recommending that Government should undertake exploitation work on a considerable scale; the logs should be dragged during the rains on to the rolling paths by means of elephants, and should thence, when the road has become hard and dry, be taken by carts to the water's edge for transport to the Brahmaputra depôts. If these means of transport are adopted, it will not be necessary to cut the trees into single *dhums*; and if it is thought that a higher price per cubic foot might be obtained for beams, or that a readier sale would be effected by placing longer timber in the market, the disposal of which would not be entirely dependent on fluctuations in the boat-building trade, the wood could be brought out in lengths of 22 or 29 feet, which would be capable of being cut up, if required, into three or four *dhums*.

The above proposal would necessitate the purchase of dragging elephants and the building of carts; but, without making an advance in this direction, the Forest Department will remain at the mercy of the duffadars, and will not obtain the proper value of its timber.

SISSU AND ACACIA-CATECHU FORESTS.

44. The area under Khair and Sissu has been estimated at 10,000 acres; but the forests have never been surveyed, and will probably, be found to be much more extensive.

These forests have been subject to annual conflagrations and consequent encroachments by grass savannahs; they have never been extensively worked; and, yielding an insignificant revenue only, they have never been cared for and protected. Were these forests fire-protected, they would soon again spread over large areas, on which they have been exterminated by constant conflagrations. Attempts should be made to introduce the cutch-boiling industry, and to fire-protect all Khair forests included within the Reserves of Western Assam.

The area on which Cutch trees might be successfully grown without outlay beyond the cost of fire-protection comprises considerable tracts in both North-Western Assam and the Jalpaiguri District in Bengal. No particular attention has been paid to these areas, as the trees have never been utilized on a large scale, an occasional house-post or a plough being the extent of the demand made on them. It would perhaps, under these circumstances, be advisable to get some cutch-boilers from Burma to instruct the people of the country, or to depute Mr. Copeland to Burma for a few months in order to learn the work practically, including the manner in which the cutch is done up for the trade.

No working-plans are at present required for these forests.

MIXED DECIDUOUS FORESTS.

45. The forests of this class, so far as they are situated in the main valley of Assam, are as yet of very little importance, either from a revenue point of view or as a source for supplying local demands. They have consequently been neglected both in regard to reservation and protection. Some blocks are fire-protected in connection with adjacent Sâl forests, but many of the Reserves are annually burnt, and large areas are being destroyed by shifting cultivation. At present no doubt these forests are nearly valueless; there is no export from them, as the less valuable woods they produce cannot bear the cost of transport; and the local market is confined to the supply of wood to planters. The Natives of the country adjacent to these forests use hardly anything but Bamboos, for the building of their houses, and thatching-grass; the former they cultivate, and the grass is found better outside the forests.

A country, however, situated like Assam, with a rich soil, secure of a seasonable rainfall, and traversed from end to end by a grand navigable river, cannot possibly remain in the undeveloped state in which it is at present.

Under these circumstances, I would advise an extension of the reservation of mixed deciduous forests, especially in the vicinity of the culturable plains. It is in such localities that well-protected forests are of use and *jhúm* areas are harmful. I would thus propose to extend the Kolahat Reserve to the boundary of the Khasia Hills District, and join the Deboka and Diju Reserves east of Nowgong in one large Reserve.

It must be the ultimate aim of the Forest Administration to protect from fire all Forest Reserves which would under ordinary cricumstances burn, and protection must be gradually extended to forests of a mixed deciduous character, as an investment towards future results.

In the absence of a sufficient demand, which would enable us to favour the more valuable species of trees, I have no recommendation to make for an improved system of working the mixed deciduous forests, and the question of working-plans for them may stand over until their reservation has been completed and their protection been insured.

TEAK PLANTATIONS IN MIXED DECIDUOUS FORESTS.

46. In order to increase the value of the mixed deciduous forests, it was considered advisable to introduce Teak into their composition, and a plantation of this species was established on the Kulsi river at the foot of the Khasia Hills.

From 1872 to 1881, 168 acres were stocked with Teak, the average cost per acre amounting to Rs. 88. The high cost is, however, to a great extent due to want of experience at the commencement of the work, as is provedby the fact that the plantations of 1879 and 1881 show an average cost of Rs. 68⅓ only.

The appearance of the trees in the Kulsi plantation is healthy, and those grown on the slopes of the hill have well-formed cylindrical trunks. On the loamy alluvium, the trees are slightly fluted, but not more so than would be the case with Teak grown under similar circumstances in Burma. The growth of the trees is satisfactory, the following representing the average sizes attained by the dominant trees in each plantation :—

Year.	Height.	Girth.
	Feet.	Inches.
1872	70	36
1873	60	29
1874	70	34
1875	59	28
1878	59	25
1879	46	17
1881	43	17

47. Since 1882 the plantation has not been extended, for the cost at which Sâl can be reproduced in Assam in quantities sufficient for the Bengal market is very low in comparison, and the wood is as highly valued and paid for on the Brahmaputra at the same rate as Teak. No doubt the cost of extraction and transport by water is less in the case of Teak, which has a considerably lighter specific weight and floats ; whereas Sâl timber requires to be supported

in the water by means of bamboos or boats. But this larger outlay occurs only at the time of reaping, and is consequently not increased by accumulating interest, which is a question of grave importance as regards money spent in planting operations, which yield a return after the lapse of many years. The situation of the Kulsi plantation, close to the banks of a floatable river, is, however, well chosen as regards export, and Teak wood will always meet a ready sale; and there can be no doubt that an annual extension of 20 acres would give a fair and permanent return some 80 years hence; but, calculating the outlay at compound interest, there is no possibility of the operations being a financial success. In case it be, nevertheless, decided that the operations are to be continued, they should be confined to the slopes of the hills, as the Teak tree grows best in well-drained soil.

EVERGREEN FORESTS.

VALUE OF EVERGREEN FORESTS.

48. Amongst the large number of trees which compose the evergreen forests of Assam are doubtless many which yield timber of excellent quality; but none of them have as yet taken possession of the general market in the way that this has happened with Teak and Sâl. Labour also is scarce in the vicinity of the most important evergreen forests, and is moreover in great demand for the Tea industry. This, of course, may change in time with the general progress of the Province; but the specific weight of the more valuable timber is almost invariably too great to permit of its being floated unsupported by boats or bamboos or woods of greater buoyancy. Attempts have on several occasions been made to send logs of *Lagerstrœmia Flos Reginæ* to Dhubri supported by dug-outs, but the distance and the dangers of the road proved too great, and the loss was in each instance so considerable that the transaction involved an actual deficit. Experiments might perhaps be repeated with *Cedrela Toona*, which floats well, and for which a remunerative market might be found; but they must be abandoned with regard to heavy woods. Any other means of transport besides rafting is, taking the great distance into consideration, too costly for timber in the rough. Thus it will be seen that there is practically no export of the enormous timber resources at the disposal of the State; and even the possibility of establishing an export trade in fancy woods, planks of which might perhaps be carried by steamer, is as yet more than uncertain. Experiments should be made in this direction.

49. The local market also is as yet in an undeveloped state, and is mainly confined to the supply of timber and wood required by the Tea industry for building purposes, tea-boxes, and making charcoal; and as forest areas, frequently of a considerable extent, are attached to most of the tea estates, a portion only of the planters' demands is supplied from State Forests. In respect to wood for tea-boxes, much might probably be accomplished by the establishment of a few saw-mills well situated alike for the supply of timber and the distribution of the outturn; for even at present boxes made of refuse Teak are still imported from Burma, though Assam possesses many woods at least as suitable for the purpose, of as neat an appearance as, for instance, *Cedrela Toona* and lighter than Teak.

The demand for charcoal, which is very considerable, is also still to a great extent supplied from the planters' own forests; but, as cultivation extends, the conditions in this respect must undergo a gradual change, and wood for charcoal will some day produce a considerable item of revenue. Formerly a large quantity of charcoal was obtained from unsettled Government forests; planters took the land on grant for the sake of the wood, and relinquished it after the trees growing thereon had been cut and converted into charcoal. This one-sided practice has, however, been abandoned, since more recent regulations require a payment for the standing crop of trees, somewhat approaching the actual value of the timber on the ground. The demand from Government forests for trees for the manufacture of dug-outs is at present probably of greater importance than the requirements of the Tea industry; but whilst the latter are

constantly growing, the demand for dug-outs is decreasing, steamers and better built boats taking their place on the main rivers.

This is by no means a matter for regret. At present the enormous waste of wood caused in the manufacture of dug-outs may be of no importance, but in questions regarding forests, and their influence on the economic conditions of the country, we have to consider the far future.

50. The India-rubber trade is a very important feature in the administration of the evergreen forests in Assam. The *Ficus elastica* is scattered throughout the almost impassable evergreen forests of Assam and the adjacent hills up to an elevation of 2,000 to 2,500 feet. In its natural state the tree germinates as a rule in the forks and on old branches of trees, wherever there is an accumulation of vegetable mould and a sufficiency of light and moisture; thence the young plant sends down epiphytic and aërial roots, taking possession of points of vantage on the tree on which it has established itself, such as decomposing spots on the trunk or on soft places in the axils of branches, till it establishes a direct connection with the soil, when it grows on its own account into a mighty forest tree. Young plants are, however, also found in openings in the natural forest and on the trunks and branches of fallen trees growing in the fastnesses of all but impenetrable jungle. The information regarding the *Ficus elastica* is as yet very incomplete, and we know practically nothing as regards the time in which a tree in the natural state attains the age at which it may be profitably tapped. The distribution and the natural habits of the tree render a rational management of the forest in favour of the *Ficus elastica* a question which, though it may not be impossible of solution, is at least one of the greatest difficulty, and, for financial reasons, in all probability impracticable. As yet no measure has been discovered by which the natural reproduction of the India-rubber tree can be effectively encouraged. Openings cut into the forest would at once be overgrown, and the young *Ficus* would have no chance of establishing itself. The only measure I can suggest is the killing of large useless trees in the heart of the forests and in the vicinity of *Ficus* trees, the crowns of which form part of the upper canopy, so that their destruction may cause a break in the shade. In future years, when these trees begin to decay, birds will probably serve to distribute the seed of the *Ficus* fruit, which they eat in large quantities. I do not think that this proposal is so far an unfounded speculation, for birds most frequently settle on the branches of dead trees, and it is remarkable how the epiphytic *Fici* take posssesion of any point of vantage. How long, however, it would take before the India-rubber tree had established itself we have no experience to enable us to predict, and till a few experiments on the above lines, which should be made—for they are cheap—have given us some information, no calculation as to a future policy can be based on the prospect of success.

So much, however, is certain that dependence on the natural supply of *Ficus elastica* would necessitate the permanent maintenance of vast forest areas, and require the reservation of all its present sources. This, however, is a step which cannot possibly be advocated, for the evergreen forests contain large areas fit for permanent cultivation, the extension of which is of far greater importance; nor is the reservation of such extensive areas required for any other reasons; and even as regards the supply of India-rubber, the result would be problematical.

RESERVATION OF EVERGREEN FORESTS.

51. The policy which up to the present has guided the reservation of evergreen forests is the selection out of the vast Forest property belonging to the State of the most valuable areas in well-defined and well-situated blocks, in order to secure these areas by a legal settlement against the time when the surrounding forests have disappeared before the advance of permanent cultivation.

The policy is *primâ facie* a sound one, and the areas of evergreen forests which have thus been set apart amount to 2,233 square miles of Reserved Forests and 323 square miles of Protected Forests.

52. I have been unable to gather any valid reason why, under the conditions above described, some of the areas were declared Protected Forests.

No doubt some of the Reserves of those I visited, more especially the Nambor Forest, contain considerable stretches of land which are eminently fitted for agriculture, and which must at some time or other be utilized for that purpose. In respect of a future local market, it will, moreover, be an advantage to have the large uninterrupted areas at present reserved broken up by belts and stretches of cultivation; and I am finally inclined to believe that forests of an evergreen character are more easily managed in blocks of from 20,000 to 30,000 acres, officers and workmen being less exposed to malarial diseases when able to retreat during the night into open fields and villages. There are not, however, sufficient reasons why in the meantime the areas should not be declared Reserves, for there is at present an ample supply of culturable land outside the areas selected for reservation; and, until this has been fully settled, the need to have recourse to any portion of the areas chosen for forests is not apparent. It will take, moreover, many years before we are in a position to state with any degree of certainty what areas should be finally abandoned; and an alienation without system might lead to the honey-combing of the Reserves with small settlements without deriving sufficiently equivalent advantages Under conditions like those found in Eastern Assam, the fear that the Government of India would oppose a rational and well considered alienation of reserved areas better adapted for permanent cultivation than to the growth of forests is untenable as a reason for establishing a second class of legally settled State Forests.

53. I have stated above that, amongst others, the Nambor Reserved Forest contains a large extent of culturable land of the best quality, which must ultimately be brought again under the plough. The proposed Chittagong-Assam Railway bisects this forest, and it would, in my opinion, be a false policy not to alienate a considerable portion, say up to one-half, of the forests in favour of the concessionists, even apart from the undoubted fact that the railway running through the forest will materially increase its value. I have written in support of this view in a separate note. As a rule, the higher-lying lands should remain under forest, the low-lying stretches being made over to the concessionists; but each forest area should be separately selected on its merits, and particular attention should, in my opinion, be paid to maintaining a railway frontage, so as to avoid any possible complication regarding the establishment of suitable export lines and the transport of forest produce across private lands. I have also, in my note regarding the Railway concessions, proposed that two Reserves should be selected and settled and maintained as State property in the Kopili Valley on the Lumding-Gauhati Railway Extension. They will be of special value for the supply of timber to Gauhati, and I beg, therefore, here to repeat my advice.

WORKING OF, AND WORKING-PLANS FOR, EVERGREEN FORESTS.

54. The extraction of timber has been effected under a permit system, a certain rate being paid for each tree of a certain kind independent of its position or size. There can be no doubt that this system is open to many objections; but I am not prepared to suggest, under existing circumstances, an improvement. Changed conditions may render a more advanced method of working feasible; but at present nothing can, in my opinion, be done except to wait for such change, and prevent in the meantime, as far as possible, a deterioration of the *peuplement*, which is the natural sequence of the extraction of the more valuable constituents of a mixed forest. This danger is more especially prevalent in evergreen forests and in a forcing climate, where seed of all sorts abounds and germinates as soon as sufficient light is admitted. To guide the character of the development and reproduction of such forests is in its way as difficult as to plant a desert, and cannot, I think, be effected without a considerable outlay. To make regular Working-Plans in such forests is out of the question, unless there is a heavy demand which makes large funds available for their treatment. Till this happens, all that it is feasible to do is to apply the broadest and simplest sylvicultural principles, *viz.*, to permit no isolated tree of a valuable species to be felled if there

is not advance growth of the same or of an equally valuable kind; to attack boldly groups of valuable trees growing in compact clumps, so as to create a blank of sufficient size to give the seed-bearers, which must be left the best chance of reproduction An enumeration of the growing stock is, on account of the large outlay connected therewith, permissible only in small well-defined areas which have to meet a special demand.

55. The exploitation of minor and accessory forest produce is carried on under a system of mahals; that is, the monopoly of extracting a particular kind of produce, or of catching elephants within a defined territory, is sold to the highest bidder. Each mahal has certain suitable conditions attached to it.

CAOUTCHOUC MAHALS.

56. The India-rubber mahals are the most important of the monopolies for the extraction of minor forest-produce. The question regarding them is dealt with at length in Chapter IX of Sir Dietrich Brandis's "Suggestions" of 1879, where a comprehensive scheme was proposed in order to protect this source of revenue, as well as the financial interests of the State in exploiting them. The gist of the proposals made by the then Inspector-General of Forests was—

(*a*) to confine the protection of the natural rubber trees to certain limited and well defined portions of the Government forests:

(*b*) to lease out the right of tapping the rubber trees in the remaining Government forests:

(*c*) under section 41 of the Indian Forest Act, to establish depôts at all the important entrepôts for India-rubber, and to require that all rubber should be brought to these stations for inspection and for the issue of a covering pass for fixed quantities, *viz.*, bags containing one maund each:

(*d*) to levy a fee on each pass, except in the case of lessees of Government rubber forests.

The outcome of these proposals was that rubber-mahals were put up to auction-sale in those parts of the Province where the article was most largely produced, and that certain well-defined areas were reserved against tapping.

57. The income derived from the sale of rubber-mahals has averaged during the last five years Rs. 32,800, and, by a simple process of deducting imports from exports, it is estimated that the amount of rubber extracted from the Government forests amounted to 5,180 maunds per annum.

It will thus be seen that Government realized an average income from the sale of their rubber of less than Rs. 6 per maund, representing only 10 per cent. of the local value; and it is evident, considering the moderate cost of extraction, that an inordinately large profit falls to the share of the Marwari monopolists. The royalty levied on rubber in Upper Burma amounts to Rs. 12 per maund, and no duty is levied on rubber imported into Assam from beyond the frontier —a fact which renders the control of the exploitation of home-borne rubber extremely difficult.

Sir Dietrich Brandis proposed to meet this difficulty in an indirect manner by levying a fee on each pass; but his suggestions in this respect were not accepted, because section 39 of the Indian Forest Act permitted the assessment of a duty on timber only, and it was thought that it would be undignified to gain the point by an undue stretching of the law. In order, however, to protect to some extent the revenues of the State, as well as the interests of the Mahaldars, passes to proceed beyond the "Inner Line" were granted only to such rubber-collectors as were servants of the monopolists in British territory. This action improved the position of the lease-holder, and tended no doubt to raise the prices paid for the mahals; but, the whole business being in the hands

of a certain community of Marwaris, the measure has not brought the bidding up to within one-third of the actual value of the monopoly. Owing to the fact that there is at present no duty on foreign rubber brought into Assam, large quantities begin to arrive from Burma, since a duty of Rs. 12 per maund has taken the place in that country of the lump-sum rent which was formerly paid for the monopoly of extraction.

58. It has since been decided to amend the Forest Act, and, amongst other improvements, to provide for the levying of a duty on all forest-produce, thereby removing the legal difficulty which to some extent caused the abandonment of the proposals made in 1879. As soon as the amendment has been effected, it will become feasible to substitute the levy of a uniform tax on all rubber exported from Assam for the sale of monopolies—a measure which at present throws the lion's share of the profits into the hands of capitalists. It has been argued against this that such procedure would cause an intolerable interference with the actual collectors of the commodity; but it must, I think, be admitted that such argument has some distinct logical flaws, for by the sale of monopolies the State merely transfers the agency of interference to a third person, and withdraws at the same time from the actual collector the possibility of making the maximum profit out of his own little transactions.

I would consequently advise that, as soon as the Forest Act is amended in the direction now before the Council of the Government of India, a uniform rate of royalty and duty be imposed on all rubber produced in Assam, or imported from beyond the frontier; and that the rate be assimilated to that now levied in Upper Burma, which is fixed at Rs. 12 per maund.

It will probably be advisable to adopt a system of transport passes, levying the amount due at the time when such pass is issued, and no hardship can result if steps are taken to provide that such passes shall be supplied by all Deputy Commissioners, all Sub-Divisional Officers, and all Forest Officers above the rank of a Range Officer. The adoption of the above proposal will at once considerably raise the income derived from rubber, and will probably double it within a short time.

FICUS-ELASTICA PLANTATIONS.

59. As far back as 1873, well-founded doubts were entertained in regard to the permanency of the supply of India-rubber obtainable from the natural forests; the difficulties of control and protection were recognized, as well as the impracticability of increasing or even maintaining within the natural forests the stock of Caoutchouc-yielding trees; and it was then decided to have recourse to artificial cultivation. Plantations were simultaneously established on the Kulsi in the Kamrup Division, on the Bamoni hill and in the Charduar Reserve in the Darrang Division. As might have been expected, the requirements of the tree were not correctly gauged in the beginning, and numerous mistakes were at first made in the selection of areas, as well as in the treatment of the plant. Some money was thus doubtless spent on operations which were either not suitable or not necessary; but, on the whole, the knowledge by which success is now assured was cheaply and rapidly acquired—a fact which reflects credit on the powers of observation and the versatility of resource of the officers connected with the solution of a new and difficult problem of sylviculture.

It does not seem necessary to give a history of failure, and it will be sufficient to record the means by which success has been gained and the extent of such success.

60. The requirements of a *Ficus elastica* plantation are, according to our present knowledge, a warm steamy atmosphere, such as is found in the evergreen forests at the foot of the hills, a fresh but well-drained soil (the tree dies on marshy inundated ground), and plenty of light. The conditions of locality have been found to perfection in the Charduar Reserve, and no extension is at present contemplated in other places; those as regards light are supplied by the cutting of clear lines through the evergreen forests. These lines have a breadth of 40 feet, separated by a narrow belt of natural forest: the centres of the lines are

100 feet apart. The atmosphere on these lines, enclosed as they are by almost impenetrable banks of forest, is a perfect steam-bath.

The plants are raised from seed in nurseries, and then bedded out in close order so that they may run up without branching. They are transplanted, when they have attained a height of some 12 to 15 feet, at a distance of 25 feet on the lines on mounds 4 feet high constructed with a centre of old roots, pieces of fallen trees and other refuse cleared off the line, which is covered with a layer of soil from 2 to 2½ feet in thickness. The young tree is planted in the middle of this mound and secured with three stout poles, to which it is tied with grass ropes or creepers. Its own height and the protection afforded by the surrounding poles make it defensible against deer. This is a matter of great importance, as it saves the cost of fencing, which formed one of the main items of expenditure so long as smaller plants were put out In some instances the young trees are knocked over by wild elephants, and damaged by stags barking their new horns against them; but practically no blanks exist in the whole of the area covered by the present plantation. A great advantage, especially in consideration of the scarcity of labour, is that the tree can be transplanted throughout the year, though of course it is advisable to select cloudy weather. The failure of even a single plant is a rare occurrence. It is, in the first few seasons, necessary to clear the lines of shrubs and coppice-growth; but within a few years the *Ficus* has taken possession of the ground on which it stands and holds its own both as regards room for roots and branches.

61. The only question which, in my opinion, still requires consideration is the planting distance within the lines. There can be no doubt that trees require already at an early age more side-room in the lines than is given by the present planting distance, even though they have ample space to develop themselves in directions vertical to the line, which, however, in many instances is already taken up beyond the originally cleared lines.

In most of the older plantations, the branches and even more so the roots are interlaced: an occurrence which at some near period must interfere, I should say, with a further vigorous development. I would propose to begin to tap every second tree and gradually to kill it out of the line, so as to make room for its neighbours. This is, however, a matter for experiment; and in case it should not prove successful, the original planting distance must be increased. Wherever the tree establishes, by means of aerial roots, a new connection with the ground, a rapid development of the whole tree takes place in the same direction, and it has occurred to me that, by binding down side branches and fixing them to the ground, a lateral development of the tree might be encouraged. This might be tried.

62. The plantation covers at present an area of 1,043 acres, and has cost Rs. 85,582, or an average of Rs. 82 an acre. The first cost has, however, of late been materially reduced, and amounts now to some Rs. 40 by the end of the sixth year, when no further clearing is required. The main expense is involved in the first cutting of the lines and keeping them clear. The cost of throwing up mounds is six annas for each, and that of planting 8 annas per tree. It is impossible to foresee the amount of rubber which will be yielded by each tree, but, judging from the outturn in natural forests, excellent financial results may be expected. In these circumstances, it is to be regretted that no extension took place during the past year on account of financial pressure, and it is hoped that the annual increase of 200 acres will in future be proceeded with without interruption.

BAMBOO FORESTS AND CANE-BRAKES.

65. These forests are worked under the Mahal System. I have no suggestions to make in regard to them.

PINE FORESTS.

66. The results of fire-protection in the immediate vicinity of Shillong show that nothing else is required for the maintenance and reproduction of

the Khasia Pine forests. Fire-protection has, on the whole, been very successful, but there have been accidents, and I had an opportunity, while on my way from Shillong to Gauhati, of seeing the difficulties which people have to contend with in getting a fire in these forests under control.

I would strongly advise the planting of safety belts of leaf-bearing trees, and would specially recommend that experiments be made with *Robinia pseudo-Acacia*, of which a few maunds of seed could easily be obtained from home.

Whether it be advisable to extend reservation in the Pine tracts beyond the area which is necessary to supply the local demands for timber and firewood depends, in my opinion, mainly on the problem whether a market can be created for the produce of the Khasia Pine forests The transport of timber, even of fashioned timber, into the plains would almost certainly be too expensive; but the tapping for resin and the manufacture of creosote might prove advantageous industries, and experiments on a small scale might be made in order to test the financial success of the undertaking.

MISCELLANEOUS.

FOREST LAW.

67. The Indian Forest Act (VII of 1878) is in force in Assam, but it is, in its present form and even when the amendments which it is now proposed to make have been promulgated, more especially inapplicable to Assam, for the same reasons which led to its rejection in Burma.

In an undeveloped country like Assam there can be no necessity whatever to create two classes of demarcated State forests, and whilst they are constituted the greater bulk of the forests remains unprotected, in so far that the Local Government can make no provision protecting certain classes of trees, or for effectively regulating the extraction of forest-produce. In these circumstances, I consider that the substitution of the Upper Burma Regulation, with the omission of section 29 and section 32, clauses (*1*) and (*2*) *c*, which refer to Teak, would be preferable. This can, I believe, be effected without legislation.

CONCESSIONS.

68. These may be divided into local privileges and concessions made to commercial enterprises. The former look at present much more formidable on paper than they are in reality, for the Assamese cultivator, though he may live in the vicinity of the forests, uses comparatively little forest-produce. His house as a rule contains no wood beyond the posts, being principally constructed of bamboos and thatching-grass; as regards the former, he prefers the species cultivated round his village as more durable, and the best thatch-grass is also usually found outside forest limits.

It is not, however, either to be hoped or expected that the circumstances will remain as they are. Cultivation must increase to the borders of the permanantly Reserved Forests, and the demands must in consequence grow both as regards quantity and quality just as they have done elsewhere.

In order to provide against this occurrence and to create a healthy local market for the produce of the State forests, which is of the greatest importance in regard to their future treatment, it is necessary that no concessions, least of all vague concessions, of an increasing tendency should be granted in any settled and demarcated State forests, where all that is legally due has been awarded as rights; nor should the system of home permits extend to such areas. It has been recognized in Assam—in fact the province took the lead in this respect—that concessions terminable at the will of Government should be granted for a specified time only.

At present the cutting of thatching-grass from district forests and other Government lands for sale, and even for export into Bengal, is unrestricted. It is surely enough to allow a liberal supply of forest-produce for the private use of the villagers. The extraction of forest-produce for sale involves a loss

of revenue not only from the open forests, but also destroys the market for that yielded by demarcated State forests; and, in my opinion, concessions should nowhere extend to forest-produce being extracted for the purposes of sale.

69. The Advocate-General has given it as his opinion that the terms of the coal-mining concession near Margherita prohibits the Government from constituting a valuable forest as a Reserve under the Act. This opinion must be accepted as correct, and care should be taken to avoid a repetition of the complication.

As regards the concessions asked for by the Chittagong-Assam Railway promoters, I have submitted a separate note to the Government of India, and all I have to recommend as a general principle is that concessions involving the supply of free timber or other forest produce, whether for construction or maintenance, from Government forests which it is not proposed to alienate, should be strictly limited in regard to time, area, quantity, and quality.

WORKING-PLANS FOR ASSAM.

70. I have, the case of the Dambu forests having been disposed of in a separate note, recorded my views of the more immediate duties of the Working-Plans Division in the paragraphs treating of Sâl forests. As regards working-plans generally, I can add nothing to the orders promulgated in letter No. 3336, dated the 7th November 1888, from the Secretary to the Chief Commissioner, to the Conservator of Forests, with which I thoroughly agree. They are sound as regards theory and most practical.

My idea is that for forests like that of Makum, for instance, all that is required is—

(1) A skeleton survey map showing main boundaries, boundaries of blocks, rivers, and lines of export, and large blanks and swamps on which there are no valuable trees. Where there were distinctly marked classes of forests, their limits should also be shewn; other topographical details could be sketched in as suggested in the Chief Commissioner's letter.

(2) An area statement giving:—

(*a*) area of each class of workable forests, block by block;

(*b*) areas occupied by blanks, &c, &c., block by block.

(3) A list showing the number of exploitable trees, *i.e.*, saleable trees of exploitable dimensions, in each block or compartment. This could be made by counting and measuring all the exploitable trees, or, as in the Burma forests, by estimating this number from countings on selected pattern areas or lines.

With the above, and notes on the reproduction, rates of growth, &c., of the exploitable species, the management and yield for the next 10 or 15 years could be fixed. It would be unsafe to provide for a longer period, as we do not known how far the demand may develop.

ESTABLISHMENTS.

71. There are two points which I wish to note under this head. The first refers to the Controlling Staff; the second to the Protective Establishment.

I consider that the separation of the two small lists of Controlling Officers belonging to Bengal and Assam was a mistake, telling of course more acutely on the smaller list, where a regular flow of promotion becomes quite impossible. A re-amalgamation can still be effected, I think, without causing individual hardship, and I would recommend the consideration of this step to the attention of the Assam Government before it is too late.

The following table would, I think, show the result of a re-amalgamation, the Deputy Conservator grade being arranged in accordance with the terms of Section 24 of the Forest Department Code :—

Rank.	Names.	Province.	Date of appointment to Controlling Staff.	Date of appointment to Grade.
Conservators (1 + 1 = 2).				
2nd grade	1. Mr. Mann ...	Assam ...	1st December 1864 ...	29th December 1888.
3rd „	2. „ Home ...	Bengal ...	1st March 1864 ...	24th April 1883.
Deputy Conservators (8 + 4 = 12).				
1st grade (1) ...	1. „ Davis ...	Do. ...	1st January 1870 ...	30th January 1887.
2nd „ (1 + 1 = 2)...	2. „ Ellis ...	Do. ...	7th January 1869 ...	23rd May 1883.
	3.* „ Jellicoe ...	Assam ...	22nd November 1871	11th November 1885.
3rd „ (4 + 1 = 5)...	4. „ Richardson ...	Bengal ...	1st May 1876 ...	3rd September 1882.
	5.* „ Mein ...	Assam ...	8th January 1876 ...	24th April 1883.
	6.* „ Chester ...	Bengal ...	12th January 1876 ...	25th September 1884.
	7.* „ Manson ...	Do. ...	26th January 1876 ...	11th November 1885.
	8. „ Green ...	Do. ...	11th February 1879...	4th October 1888.
4th „ (2 + 2 = 4)...	9. „ Grant ...	Do. ...	13th September 1869	3rd September 1882.
	10.* „ Fordyce ...	Do. ...	21st January 1880 ...	7th May 1888.
	11.* „ Fowler ...	Bengal ...	31st January 1881 ...	2nd April 1888.
	12.* „ Lillingston ...	Assam ...	23rd February 1882...	1st January 1886.
Assistant Conservators (5 + 4 = 9).				
1st grade (2 + 2 = 4) ...	1.* „ Barker ..	Assam ...	31st Jnanary 1882 ...	2nd November 1885.
	2. „ Copeland ...	Do. ...	1st May 1882 ...	11th November 1885.
	3. „ Heinig ...	Bengal ...	15th June 1882 ...	1st January 1886.
	4. „ Campbell ...	Assam ...	3rd September 1882...	7th May 1888.
2nd and 3rd grades (3 + 2 = 5).	5. „ Young ...	Do. ...	1st June 1882 ...	8th November 1886.
	6.* „ Rogers ...	Bengal ...	7th January 1888 ...	7th November 1888.
	7.* „ French ...	Do. ...	8th January 1886 ...	8th January 1886.
	8.* „ Fisher ...	Assam ...	14th December 1886...	14th December 1886.
	9.* „ Haines ...	Bengal ...	1st January 1889 ...	1st January 1889.

72. In regard to the Protective Establishment, I beg to draw attention to paragraph 74 of the Progress Report of Forest Administration in Assam for 1887-88. In my opinion, a mistake has been committed in reducing the number of the Protective Establishment for financial reasons. Either the number is permanently required or not. This must be ascertained and fixed on a wider basis than the temporary fall in revenue.

The policy of Government must in this respect, as well as in respect of works of permanent improvement, be more constant and less influenced by variations in revenue, as the financial aspect of the future depends to a great extent on present action.

Summary.

73. The following is a resumé of the proposals which I beg to submit for the consideration of the Local Government:—

(*a*)—*Paragraph 21.*—The reservation of the outlying patches of Sâl forests, together with the surrounding savannahs, in

the Goalpara District and the south-west corner of the Kamrup District.

(*b*)—*Paragraphs 22-23.*—The restriction of *jhûming* in the hill Sâl forests, and the extension of reservation in the Garo, Khasi, Jaintia, and Mikir hills.

(*c*)—*Paragraph 26.*—The immediate extension of fire-protection to all submontane Sâl forests.

(*d*)—*Paragraph 28.*—The introduction of arbori-*jhûm* cultivation in the fire-protected Bamboo forests.

(*e*)—*Paragraph 29.*—The formation of compact blocks of hill Sâl forests in order to facilitate fire-protection, and extension of the latter to all hill Sâl forests.

(*f*)—*Paragraphs 32-43.*—The introduction of a more systematic method of working the Sâl forests, based on area; and, in order to render this possible, the separation of the different classes of forests and their survey.

(*g*)—*Paragraph 44.*—Experimental Cutch boiling.

(*h*)—*Paragraph 45.*—Extension of reservation in mixed deciduous forests in the vicinity of the culturable plain lands.

(*i*)—*Paragraph 52.*—Transformation of the Protected Forests into Reserved Forests.

(*k*)—*Paragraph 53.*—Methodical alienation of evergreen reserves for permanent cultivation and reservation in the Kopili valley.

(*l*)—*Paragraph 54.*—The abandonment of the attempt to make regular Working-Plans for evergreen forests, if the demand for produce is irregular.

(*m*)—*Paragraph 58.*—The introduction of a uniform rate of royalty at Rs. 12 per maund on all rubber, as soon as the Forest Act has been amended or the Upper Burma Forest Regulation adopted.

(*n*)—*Paragraph 61.*—The tapping to death of every second tree in the Charduar *Ficus* Plantation, and the encouraging of side development.

(*o*)—*Paragraph 62.*—The continued extension of the Charduar Plantation.

(*p*)—*Paragraph 66.*—The formation of safety belts, and experiments regarding the utilization of Pine Forests.

(*q*)—*Paragraph 67.*—The substitution of the Upper Burma Forest Regulation for the existing Forest Act.

(*r*)—*Paragraph 69.*—Concessions not to be granted in Reserved Forests.

(*s*)—*Paragraph 70.*—Simplicity in Working-Plans.

(*t*)—*Paragraph 71.*—Reamalgamation of the Bengal-Assam Lists.

(*u*)—*Paragraph 72.*—Permanent policy in regard to Establishments.

SIMLA :
30th July 1889.

B. RIBBENTROP,
Inspector General of Forests.

Appendix A.

Areas of Demarcated State Forests in the Province of Assam

Districts	Sal Forests		Deciduous Forests.		Evergreen Forests		Total.		
	In Reserves	In Protected Forests	In Reserves.	In Protected Forests	In Reserves	In Protected Forests.	Reserved Forests.	Protected Forests.	Total.
	Sq miles.	Sq miles	Sq miles	Sq. miles.	Sq miles	Sq. miles	Sq miles	Sq. miles.	Sq miles.
Garo Hills ...	93	...	25	...	15	...	133	...	133
Goalpara ...	355	...	250	...	20	...	625	...	625
Kamrup ...	113	3	15	...	...	...	128	3	131
Darrang ...	2	...	42	...	250	...	291	...	291
Nowgong ..	36	...	75	...	...	...	111	...	111
Sibsagar ...	...	...	...	20	752	10	752	30	782
Lakhimpur ...	...	...	..	60	302	96	302	156	458
Cachar ..	1	...	...	428	741	80	745	508	1,253
Sylhet ...	...	...	70	103	100	137	170	240	410
Khasia Hills ..	.	...	...	...	50	...	50	...	50
Total ..	600	3	177	611	2,233	323	3,310	937	4,247

Appendix B.

List of Trees in the Garo Hills, by Mr. T. J. Campbell, Assistant Conservator of Forests.

Local names	Scientific names	Remarks.
Sâl ...	Shorea robusta	Worked out as canoes in logs for boats, posts for building, and being converted into railway sleepers at Dambu.
Makria ...	Schima Wallichii ...	A large tree, wood very hard, used for boats and husk bowls In the hills particularly, the chief associate of Sâl and is also found in lower hill mixed forest. Seeds profusely.
Sida ...	Lagerstromia parviflora ...	A large tree, good workable timber, would make tea-boxes. The chief associate of Sâl in the plains, but is also scattered throughout the hills Seeds profusely.
Garokat ...	Aporosa dioica ...	A middling sized tree, found in abundance in Sâl forests and in mixed forests in the hills. Wood very hard, impervious to white ants, and is that mostly used by Garos for building.

List of Trees in the Garo Hills, by Mr. T. J. Campbell, Assistant Conservator of Forests—contd

Local names.	Scientific names.	Remarks.
Akshi ...	Dillenia pentagyna ...	Freely associated with Sâl, also found in mixed plain forests. Timber of little or no value, except for charcoal.
Gunseroi ...	Cinnamomum glanduliferum.	Sparsely distributed in mixed upper and lower hill forest. Good timber, fit for canoes and building.
.....	Taxus baccata ...	Found at a very high elevation only.
.....	Castanopsis Hystrix, Quercus ferox, Quercus serrata.	These three trees grow to a considerable height and girth, and are usually found above 1,000 feet, though a few scattered trees are sometimes found at lower elevations. Well shaded and damp localities are favoured by them. They are not used by Garos.
Nahor ...	Mesua ferrea ...	Found between 2,000 and 3,000 feet high in the Garo Hills on the Central Range, though at a lower elevation in the south-east of the district Good for house posts, and when seasoned for beams. Seed used for oil.
Ajhar ...	Lagerstromia Flos-Reginae	Grows exclusively in damp localities, on margins of rivers, &c, at the foot of the hills. Makes excellent boats, planks and posts. Excellent seed-bearer.
Poma ...	Cedrela Toona ..	Found in plain and lower hill mixed forests, good timber for planks and furniture, also canoes Succumbs to white ants. Seeds profusely.
Karam ...	Adina cordifolia ...	A large deciduous tree, chiefly found in the plains No use made of this in the Garo Hills.
Sam ...	Artocarpus Chaplasha ...	Chiefly found in mixed plain forest. Timber very good, particularly for canoes, Garos use bark for bedding, consequently the quantity is limited.
Khokon ...	Duabanga sonneratioides...	Grows in damp localities, near margins of rivers, &c. Not found in large quantities in this district. Used for boats, and, when seasoned, good for tea-boxes.
Jia ...	Garuga pinnata ...	Spasely distributed in mixed plain and lower hill forests. Chiefly used for canoes.

List of Trees in the Garo Hills, by Mr. T. J. Campbell, Assistant Conservator of Forests—contd.

Local names.	Scientific names.	Remarks.
Kattra ...	Bauhinia malabarica, Bauhinia variegata.	Wood inferior, only fit for firewood. Grows in great abundance throughout the district, especially on lower hills.
Sonalu ...	Cassia Fistula ...	Grows indiscriminately throughout the district. Is very hard and much used for house-posts. This tree falls under Gurkati, and, owing to its durability, is extracted in immense quantities, so much so that it is rapidly disappearing and is never allowed to grow to any size. Coppice-shoots chiefly supply the present demand. It was proposed to exclude this tree from Gurkati, as it is disappearing, but the Deputy Commissioner objected, unless some other excluded timber was substituted for it.
Rumgach ...	Englehardtia spicata ...	Found scattered to a small extent in hill forests. Makes good planks.
Jamu ...	Eugenia Jambolana ...	Scattered in mixed plain and lower hill forests. There are two or three other species of Eugenia, but none are of any value
.....	Excaecaria baccata ..	Grows scattered in lower hill mixed forests, not used.
Mas ...	Hibiscus macrophyllus ...	Found to a very large extent, particularly in the south-east of the district, much used for house-posts and oars. Grows to a good height, but seldom girth.
Jhagru ...	Macaranga gummiflua ..	A small tree, found in great abundance in pre-existent jhúms. Grows freely amongst tarai bamboos, and is sometimes gregarious.
Amluki ...	Phyllanthus Emblica ...	Grows extensively in deciduous plain and lower hill forests. Wood not used Fruit one of the Myrobolams
Bhi ...	Salix tetrasperma ...	Found in lower hill mixed forests, in vicinity of moist and swampy localities. Timber inferior.
Amphak ...	Sponia orientalis ...	A small tree, springs up on jhúms and cleared spots. Bark used by Garos for bedding.
Silikha ...	Terminalia citrina ...	Found in lower hill forest, scattered freely. One of the Myrobolams Timber useless.
Bolnawak (Garo)	Æsculus punduana ...	A small tree, found near water courses, &c , in lower hill forest. Wood of little value.
Bur ...	Ficus indica ...	Found sparsely scattered in lower hill mixed forest.
Pakri ...	Ficus cordifolia ...	Found on old village sites and in their vicinity.
Pipul ...	Ficus religiosa ...	Found on old village sites and in their vicinity.

List of Trees in the Garo Hills, by Mr. T. J. Campbell, Assistant Conservator of Forests—contd.

Local names.	Scientific names.	Remarks.
Atta-bur ...	Ficus elastica ...	Very few of these trees remain, or probably ever existed, and those which survive have been over-tapped. They are chiefly found south-east of the district.
Gomari ...	Gmelina arborea ...	Found in lower hill mixed or deciduous forests. Wood good for planks, being light and easily workable. Seeds profusely. Seldom grows to any great height. Garos use it for drums.
Koroi ...	Albizzia odoratissima ...	Found in almost every description of forest, grows much scattered, and occupies a prominent position throughout the southern half of the district particularly. Seeds profusely, a good, hard wood, makes excellent boats, and is used in buildings.
Siris ...	Albizzia procera	Grow freely in the same way as the Koroi. Not used in the Garo hills. Wood not durable, would probably make tea-boxes and charcoal. These trees are those recently advocated as shade protectors for tea. Good seed-bearers.
San ...	Albizzia stipulata	
Paroli ...	Stereospermum chelonoides	A very large, valuable tree, found throughout the hills. Particularly hardy, grows solitary among coarse grasses, as well as in good mixed forest Used for boats, planks, &c. Good seed-bearer.
Simal ...	Bombax malabaricum ...	Wood middling, fit for tea-boxes and charcoal, and is valuable in water. Scattered sparingly throughout the district. Not used by Garos.
Palas ...	Butea frondosa ...	A deciduous tree, almost wholly found in the plains. Not used by Garos.
Kumbi ...	Careya arborea ...	Found to a large extent in deciduous and Sâl forests Wood small and useless.
Bhola ...	Semecarpus Anacardium...	A deciduous tree usually found in mixed plain forests, also with Sâl. Timber valueless. Ripe fruit eaten cooked, and pericarp used in medicine, as well as for marking ink.
Amra ...	Spondias mangifera ...	A deciduous tree. Wood useless. Fruit eaten.
Udal ...	Sterculia urens ...	A large deciduous tree, found in mixed plain and lower hill forests Fibre converted into good rope. Coppices well.

List of Trees in the Garo Hills, by Mr. T. J. Campbell, Assistant Conservator of Forests —concld.

Local names.	Scientific names.	Remarks
Kadam ...	Anthocephalus Cadamba...	These trees are found in small numbers near villages and the sites of abandoned villages They have been reared by the people.
Kathal ...	Artocarpus integrifolia ...	
Mangoe ...	Mangifera indica ...	
Mangoe (wild)...	Mangifera sylvatica ...	
Nim ...	Melia Azadirachta ...	
Suala ...	Tetranthera monopetala ...	
Tamarind ...	Tamarindus indica ...	
Bael ...	Ægle Marmelos ...	

[H. B.]

G. C. Press, Simla—No. 157 R. & A. D.—10-8-89—150.